REMARKS

This reply encompasses a bona fide attempt to overcome the rejections raised by the Examiner and presents amendments as well as reasons why the applicants believe that the claimed invention is novel and unobvious over the closest prior art of record, thereby placing the present application in a condition for allowance.

Regarding Claim Status

Claims 1-19 and 22-42 were presented for examination. Claims 20-21 were inadvertently absent from the original claim set and are accordingly cancelled herein. The renumbering of original claims 22-42 is acknowledged. However, 37 CFR 1.126 requires that the original numbering of the claims to be preserved throughout the prosecution. Accordingly, this amendment preserves the original numbering of the claims, with claims 20-21 being cancelled.

Claims 1-11, 13-18, 22, 24-27, 29-30, and 32-42 were rejected. Claims 12, 19, 23, 28, and 31 were objected to as being dependent upon a rejected base claim, but have been indicated as would be allowable. Applicants thank the Examiner for indicating the allowable subject matter in these claims. Claim 2 is amended. No new matter is introduced. By the amendments submitted herein, claims 1-19 and 22-42 are pending.

Regarding 35 U.S.C. § 112, Second Paragraph, Rejections

Claim 2 was rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, it was contented that "*step d2) defers the performing act if motion/saturation has occurred, yet step d3) terminates the performing act if motion/saturation has occurred.*"

It is respectfully submitted that there appears to be a misinterpretation of the claim language and perhaps a misunderstanding of the underlying "soft decision" rule taught and described in the present invention [Spec. page 28, lines 1-21]. Claim 2, step d2) originally recites: "updating said illumination estimation with said illumination measurement if

motion/saturation has occurred but terminating said performing act is deferred." That is, step d2) "updates" a certain value if a criterion set forth in the "if" clause is met. Step d2) does not "defer" a certain action if a particular event has occurred.

To further clarify, claim 2 is amended herein to recite, "updating said illumination estimation with said illumination measurement if motion/saturation has occurred and if terminating said performing act is deferred." Accordingly, claim 2 is submitted to have overcome the rejection under 35 U.S.C. § 112, second paragraph.

Regarding 35 U.S.C. § 102 Rejections

Claims 1, 17, 18, and 22 were rejected under 35 U.S.C. § 102(b) as being anticipated by Ferre *et al.* (U.S. Patent No. 5,063,524, hereinafter referred to as "Ferre"). The rejections are respectfully traversed.

THE PROPER MEANING OF THE TERMS "PIXEL" AND "IMAGE SENSOR" USED IN THE CLAIMS

Pertinent case law has made clear that **Patent Examiners must rely on the applicant's disclosure to properly determine the meaning of terms used in the claims.** Markman v. Westview Instruments, 52 F.3d 967, 980, 34 USPQ2d 1321, 1330 (Fed. Cir.) (en banc), aff'd, U.S., 116 S. Ct. 1384 (1996) (emphasis added).

A pixel of an image is **NOT** the same as a pixel of an image *sensor*. The former refers to the basic unit of a digitized picture. The latter refers to the basic unit of an imaging system and apparatus. The latter is specifically defined and taught in the present application [see, e.g., Spec. Background; page 11, lines 3-17; FIG. **1**].

As described in the present application with reference to FIG. **1**, an image sensor captures light on an array or grid of small pixels on their surfaces. During capture, each pixel converts incident light into photocurrent [Spec. page 11, lines 2-12].

At the time the invention was made, charge-coupled device (CCD) image sensors were the standard image sensors. The CCD gets its name from the way the charge on its pixels are read after an exposure. After the exposure the charge on the first row are transferred to a place on the sensor called the read out register. From there, the signals are fed to an amplifier and then on to an analog-to-digital (A/D) converter. Once the row has been read, its charge on the readout register row are deleted, the next row enters, and all of the rows above march down one row. The charge on each row are "coupled" to those on the row above, so when one moves down, the next moves down to fill its old space. In this way, each row is read one row at a time. As specifically discussed in the background section of the present application, in CCD image sensors, these functional operations cannot even be integrated on the same chip, let alone performing at the pixel-level.

FERRE NEITHER EXPRESSLY NOR INHERENTLY TEACH EACH AND EVERY CLAIM ELEMENT AS DESCRIBED IN THE PRESENT APPLICATION

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). Thus, it would be improper to consider the claim language "motion/saturation" to be anticipated by any reference that contains only one element and does not contain each and every element as set forth in the claims.

Ferre does not anticipate each and every element as set forth in claims 1, 17-18, and 20. For example, as to independent claim 1, Ferre does not teach or describe **performing *for each pixel* of an image sensor**:

a) determining a difference between an illumination measurement obtained *during current image capturing* and an illumination estimation generated during *previous image capturing*;

b) comparing the difference with a threshold value; and

c) determining, based on step b), whether motion/saturation has occurred.

Ferre is directed to an **image analysis** method that *transforms* an image for the purpose of measuring significant characteristics (in this case, motion) thereof [see, Class Definition 382 <http://www.uspto.gov/go/classification/uspc382/defs382.htm>]. More specifically, Ferre concerns a method that **estimates the motion of a target in a sequence of images** [col. 1, lines 9-18]. The "pixel" in the cited column 2, lines 63-66, of Ferre is part of what defines a "**target**" [col. 1, lines 26-28; col. 2, lines 64-68] and is most definitely not a pixel *of* an image sensor.

Ferre does mention implementations where each image is sampled at dimensions of 256 x 256 or 128 x 128 pixels [col. 3, lines 27-28; col. 7, lines 59-61]. It is clear, however, that these dimensions refer to the *size* of the images **given by an image sensor** [col. 3, lines 28-29; col. 7, lines 65-66; FIG. 4].

That is, Ferre **analyzes a sequence of images given by an image sensor** and does not perform, **for each pixel of an image sensor**, any functional operations whatsoever to **prevent** motion/saturation **at the pixel level, *during* a global exposure time *of* the image sensor**, and ***before*** outputting the images to terminal **1** of FIG. **4**. It is unequivocally clear that Ferre is limited by the quality of images provided by a conventional, **standard image sensor** [Ferre, col. 3, lines 25-29] having the same or similar weaknesses and drawbacks as described in the background section of the present application [Spec. page 2, lines 17-20].

The claimed invention addresses these problems with a **new image sensor** that includes novel photocurrent estimation and motion/saturation detection **performed for each pixel** during image capturing within a global exposure time of an image sensor. This is completely, fundamentally, and patently different from performing image transformation on a sequence of images provided by a standard image sensor. For at least this reason, Ferre is submitted to be non-applicable and not materially relevant to the claimed invention.

As to claim 17, Ferre does not teach or describe a soft decision rule as taught and described in the present application. It is unclear how the cited column 6, lines 27-67, and column 7, lines 1-2, of Ferre has anything to do with a locally made decision, local as to a pixel (of an image sensor), whether to stop estimating photocurrent (of that pixel) after motion is detected (at the pixel) [Spec. page 28, lines 1-4]. Note the phrase "for preventing error accumulation due to slow motion" is directed to the *function* of the soft decision rule and should be considered as a claim limitation. The same fallacy exists on page 4 of the Office Action with regard to claim 18.

Furthermore, Ferre is distinguished from independent claim 22 at least because Ferre does not teach or describe:

a) capturing a first image sample;

b) generating **for each pixel** a current illumination estimation based on said first captured image sample;

c) capturing a next image sample;

d) determining **for each pixel** whether motion/saturation has occurred and whether to include said next image sample;

e) repeat steps c) and d) until no more image samples are to be captured.

Again, Ferre utilizes a standard image sensor and lacks any detail teachings on "per pixel" operations thereof. Moreover,

- Ferre analyzes captured images given by an image sensor.
- The claimed invention performs estimation **for each pixel** *during* image captures.
- Ferre estimates the motion of a target *in* a sequence of images.
- The claimed invention estimates the photocurrent (illumination) **for each pixel** *of* an image sensor.

In summary, **Ferre does not improve any image sensors and Ferre does not show an identical invention in as complete detail as is contained in the claims.** Accordingly, claims 1, 17-18, and 22 are submitted to be patentable over Ferre under 35 U.S.C. § 102(b).

Regarding 35 U.S.C. § 103 Rejections

Claims 3, 13-14, and 16 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ferre in view of Sezan *et al.* (U.S. Patent No. 5,600,731, hereinafter referred to as "Sezan"). The rejections are respectfully traversed. The first paragraph on page 5 of the Office Action is not applicable because the present application, as recorded on 03/05/2002, is assigned to a single entity (owner) having the entire right, title, and interest thereto.

Sezan is in the same field of endeavor as Ferre, i.e., an image analysis method for detecting motion in a sequence of images. Sezan also uses the term "pixel" to refer to the basic unit of an image, not of an image sensor. Similar to Ferre, Sezan also lacks any teachings on performing "per pixel" operations ***during* a global exposure time *of* an image sensor**. Since Sezan does not and cannot fill the void of Ferre, one of ordinary skill in the art, at the time the invention was made and upon learning Ferre and Sezan, would not and could not have arrived at an invention as set forth in the claims.

Relying on *In re* Fine, 5 USPQ 2d 1596, 1600 (Fed. Cir. 1988) and *Ex parte* Kochan, 131 USPQ 204 (Bd. App. 1960), dependent claims 3, 13-14, and 16 are submitted to be patentable per their parent independent claim 1, which is submitted above as patentable.

Claims 4, 7, 24-25, 27, 32, and 34 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ferre in view of Pucker, II *et al.* (U.S. Patent No. 6,298,144, hereinafter referred to as "Pucker"). The rejections are respectfully traversed.

As to independent claim 24, Ferre teaches a standard image sensor, *supra*. Ferre does not teach or suggest, *during* a global exposure time of an image sensor, a motion/saturation detecting means for determining **for each pixel** whether motion/saturation has occurred between a previous capturing and a current capturing. Again, according to the present

application, during capture, each pixel converts incident light into photocurrent [Spec. page 11, lines 9-12].

Pucker does not and cannot filled the void of Ferre at least because Pucker does not teach or suggest capturing image samples, nor does it teach or suggest a processing means for determining **for each pixel** whether to accept an image sample so captured. For at least these reasons, claim 24 is submitted to be patentable over Ferre in view of Pucker.

Pucker is in the same field of endeavor as Ferre, i.e., an image analysis method for detecting motion in a sequence of images. Pucker also uses the term "pixel" to refer to the basic unit of an image, not of an image sensor. Again, multiple images (a sequence of images) provided (generated) by an image sensor are patently distinguishable from multiple image samples *captured* by an array of pixels of an image sensor.

Similar to Ferre, Pucker lacks any teachings on performing "per pixel" operations ***during* a global exposure time *of* an image sensor**. Since Pucker does not and cannot fill the void of Ferre, one of ordinary skill in the art, at the time the invention was made and upon learning Ferre and Pucker, would not and could not have arrived at an invention as claimed.

Note that a claim may not be rejected solely because of the type of language used to define the subject matter for which patent protection is sought. Applicant may use functional language, alternative expressions, negative limitations, or any style of expression or format of claim which makes clear the boundaries of the subject matter for which protection is sought. *In re Swinehart*, 439 F.2d 210, 160 USPQ 226 (CCPA 1971). The language in claim 24, "thereby preventing motion/saturation from corrupting image capturing," as well as in claim 27, "wherein m1, m2, and length of global exposure time are chosen so to achieve a desirable balance ...," make clear the boundaries of the subject matter for which protection is sought and therefore should be considered.

Reliance is placed on *In re* Fine, 5 USPQ 2d 1596, 1600 (Fed. Cir. 1988) and *Ex parte* Kochan, 131 USPQ 204 (Bd. App. 1960) for the allowance of dependent claims 4, 7, 25, 27,

32, and 34 since they differ in scope from their respective parent independent claims 1 and 24 which are respectively submitted above as patentable.

Claims 5, 8, and 36 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ferre in view of Pucker and further in view of Sebe *et al.* (hereinafter referred to as "Sebe"). The rejections are respectfully traversed.

Sebe is in the same field of endeavor as Ferre and Pucker, all of which relate to methods of image analysis and pattern recognition. The maximum likelihood estimation in Sebe is used to match stereo images and is not for generating an optimal illumination estimation for an image sensor.

Similar to Ferre and Pucker, Sebe lacks any teachings on performing "per pixel" operations ***during* a global exposure time *of* an image sensor**. Since Sebe does not and cannot fill the void of Ferre and Pucker, one of ordinary skill in the art, at the time the invention was made and upon learning Ferre, Pucker, and Sebe would not and could not have arrived at an invention as claimed.

Relying on *In re* Fine, 5 USPQ 2d 1596, 1600 (Fed. Cir. 1988) and *Ex parte* Kochan, 131 USPQ 204 (Bd. App. 1960), dependent claims 5, 8, and 36 are submitted to be patentable per their respective parent independent claims 1 and 24 which are respectively submitted above as patentable.

Claims 6, 9, 26, 33, 35, and 37 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ferre in view of Pucker and further in view of Sezan. The rejections are respectfully traversed.

Ferre, Pucker, and Sezan, as discussed above, are all in the same field of endeavor and are all directed to analyzing images provided by standard image sensors. In Ferre, Pucker, and

Sezan, the term "pixel" refers to the basic unit of an image and not of an image sensor. Ferre, Pucker, and Sezan, all lack any teachings on performing "per pixel" operations ***during* a global exposure time *of* an image sensor**. Accordingly, one of ordinary skill in the art, at the time the invention was made and upon learning Ferre, Pucker, and Sezan, would not and could not have arrived at an invention as claimed.

Reliance is placed on *In re* Fine, 5 USPQ 2d 1596, 1600 (Fed. Cir. 1988) and *Ex parte* Kochan, 131 USPQ 204 (Bd. App. 1960) for the allowance of dependent claims 6, 9, 26, 33, 35, and 37, since they differ in scope from their respective parent independent claims 1 and 24 which are respectively submitted above as patentable.

Claims 10 and 11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ferre in view of Dong (U.S. Patent No. 5,734,426). The rejections are respectfully traversed.

The alleged combination of Ferre and Dong suffers the same deficiency as discussed above with regard to Ferre. In addition, the claim limitations, "thereby enabling performing for each pixel independently of other pixels' lighting conditions" and "thereby enabling extending said global exposure time," make clear the boundaries of the subject matter for which protection is sought and therefore should be considered.

Dong is directed to a method of controlling an exposure time of a metal oxide semiconductor imaging array. According to Dong, the retrieval of information from the pixels follows the well known raster scanning technique. That is, each roll of pixels is scanned sequentially from left to right until all rolls have been scanned sequentially from top to bottom. At the end of each complete scan of the entire array of pixels, a vertical blanking period of a predetermined time occurs until the well known raster scanning pattern is repeated.

In Dong, as each pixel is scanned per the NTSC television standard scanning scheme, the signal from the pixel is sequentially amplified at two stages. The magnitudes of the amplified signals from each of the pixels are then used to determine the exposure time for each pixel.

The exposure time for each pixel is controlled by a raster scan control algorithm [col. 2, lines 50-54]. Dong does **not**, explicitly or implicitly, teach or suggest enabling **each pixel** to control its own exposure time to adapt to its own lighting condition, as set forth in claim 10, and enabling **each pixel** to terminate its own exposure time, as set forth in claim 11. Accordingly, claims 10 and 11 are submitted to be patentable over Ferre in view of Dong.

Reliance is placed on *In re* Fine, 5 USPQ 2d 1596, 1600 (Fed. Cir. 1988) and *Ex parte* Kochan, 131 USPQ 204 (Bd. App. 1960) for the allowance of dependent claims 15 and 29-30, since they differ in scope from their parent independent claim 24 which is submitted above to be patentable.

Claims 38-42 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ferre in view of Pucker and further in view of Merrill *et al.* (U.S. Patent No. 5,962,844, hereinafter referred to as Merrill). The rejections are respectfully traversed.

The alleged combination of Ferre, Pucker, and Merrill suffers the same deficiency as discussed above with regard to Ferre and Pucker, individually and in combination. What is more, Merrill fails to fill the void of Ferre and Pucker. For example, Merrill teaches "row reset". Contrastingly, claim 38, which depends on claim 24, recites a "self-reset pixel" architecture in which self-reset is performed "per pixel". Merrill teaches "active pixel sensors" (APS). On the other hand, claims 39 and 40 recite "digital pixel sensors" (DPS). The applicability of Merrill notwithstanding, dependent claims 38-42 are submitted to be patentable per *In re* Fine, 5 USPQ 2d 1596, 1600 (Fed. Cir. 1988) and *Ex parte* Kochan, 131 USPQ 204 (Bd. App. 1960).

Conclusion

For the foregoing reasons, it is respectfully submitted that the claimed invention recites subject matter not reached by Ferre, Sezan, Pucker, Sebe, Dong, and Merrill, individually

and in their various combinations, under 35 U.S.C. §§ 102(b) and 103(a). Accordingly, claims 1-11, 13-18, 22, 24-27, 29-30, and 32-42 are submitted to be patentable and therefore should be allowed. Claims 12, 19, 23, 28, and 31 have been indicated as would be allowable.

This Response/Amendment is submitted to be complete and proper in that it places the present application in a condition for allowance without adding new matters. Since the Examiner has done a thorough search in view of the entire application disclosure and cited the best references at his or her command under 37 CFR 1.104, no new search should be necessary. Favorable consideration and a Notice of Allowance of all pending claims 1-19 and 22-42 are therefore earnestly solicited.

The Examiner is sincerely invited to telephone the undersigned at 650-331-8413 for discussing an Examiner's Amendment or any suggested actions for accelerating prosecution and moving the present application to allowance.

Respectfully submitted,

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